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Cover image was provided courtesy of the undergraduate research of Matthew Hartman at NC State from "Murine Fibroblast Response to Aligned Polylactic Acid Nanofibers" beginning on page 22 of this issue. The image is of a relatively small fibroblast growing along a set of parallel fibers taken at 2500x.
EDITORIAL BOARD

Editor-in-Chief: Ashle M. Page

Ashle M. Page is a senior at NC State University graduating in Spring 2017 with a B.S. in Chemical Engineering, a B.S. in Polymer and Color Chemistry and a Minor in English. As an undergraduate, Ashle has performed undergraduate research during four internships with NASA and with on-campus labs. She has also served as Content Editor for The Journal of Reflective Inquiry (JORI) and as a writer for the NC Department of Cultural Resources, in addition to acting as a student leader for the Institute for Emerging Issues, Service Raleigh, and Committees on International Programs and Student Health. In her spare time, Ashle enjoys being active in church, playing golf and softball, and spending time with family.

Editor-in-Chief: David Nacouzi

David Nacouzi is a senior at NC State University graduating in Spring 2017 with a B.S. in Physics and a B.S. in Applied Mathematics. He was born and raised in North Carolina and will continue his studies as a Master's student in Medical Physics at Duke University. David's hobbies include research, running two non-profit startups (TeacherLoop and Innovative Medical Strategies), skiing, scuba diving, and Brazilian jiu-jitsu. His goal includes starting a research think tank centered around human engineering in the pursuit of developing Homo Evolutis (man that evolves himself).

Assistant Editor: Chanelle Gobena-McArthur

Chanelle Gobena-McArthur is a senior at NC State University graduating in December of 2017 with B.S.'s in Science, Technology, and Society and Political Science. During her time at NC State, she has published several research projects, in addition to working as a mentor to fellow undergrads.

Assistant Editor: Thiago De Souza

Thiago De Souza is a senior at NC State University studying Communication Media with a double minor in English and Statistics from Bauru in São Paulo, Brasil. He likes to rap and is usually at the NC State Freedom Expression Tunnel Cypher on Monday nights. Thiago is also big into music and film. His family and dog keep him motivated.

Assistant Editor: Supriya Sivadanam

Supriya Sivadanam is a rising senior in the University Honors Program at NC State University majoring in Biomedical Engineering (BME) with a minor in Biology. She is an undergraduate researcher in the Advanced Wound Healing lab in the BME department. Outside of school, she enjoys reading, writing, drawing, and listening to music.

Designer: Sophie Bergere

Sophie Bergere is a senior at NC State University and will be graduating with a bachelors in Graphic Design in Fall 2017. She is on the Executive Committee for her sorority Zeta Tau Alpha, and is also a part of Habitat for Humanity and the National Society for Leadership and Success. After graduation, Sophie would like to stay in Raleigh, NC, and get a job in either UX (user experience) or editorial design.

Faculty Advisor: Christopher Ashwell, Ph.D.

Dr. Christopher Ashwell is the Director of NC State University's Office of Undergraduate Research (OUR). He received his B.S. in Biochemistry and Nutrition from Virginia Polytechnic Institute and State University then continued his education at the Bowman Gray School of Medicine at Wake Forest University, receiving his Ph.D in Biochemistry. His graduate work focused on the characterization of the peptide substrate binding properties of the eukaryotic signal peptidase enzyme complex. As a postdoctoral researcher, Dr. Ashwell worked in the Growth Biology Laboratory of the USDA's Agriculture Research service at Beltsville, MD, and was eventually hired as a Research Molecular Biologist. In 2003, he joined the faculty of NC State in the Department of Poultry Science, researching the identification of the gene(s) underlying traits of economic importance in poultry, before assuming his current role in OUR.
EDITOR’S NOTE

It is with great pleasure that we present the 2017 Spring Issue of *INK: The Undergraduate Research Journal at NC State University*. This long-awaited issue comes five years after the last issue of *INK* was published in 2012. The Editorial Board has worked tirelessly to revitalize the journal and ensure its future as a continued presence at NC State.

This issue exhibits some of the best work of undergraduate students at NC State. Articles range from independent studies of innovative textile fibers, urban planning, and engineering, to animal biology and scientific reviews. At NC State, we “Think and Do.” *INK* showcases students who put the essence of this motto into action.

The Editorial Board would like to acknowledge the mentorship of *INK*’s faculty advisor, Dr. Christopher Ashwell, Director of the Office of Undergraduate Research (OUR), in addition to Ms. Judy Day and Ms. Heather King also from OUR. We would also like to thank the peer reviewers who came from multiple disciplines at NC State to dedicate much time and energy to reviewing articles. The Editorial Board would additionally like to express gratitude for the guidance provided by Mr. William Cross, Ms. Lillian Rigling, and Mr. Darby Orcutt, from NC State Libraries. Finally, we would like to thank the student authors and mentors of the articles featured in this issue who demonstrated excellence within both the technicalities and communication aspects of their research.

We are excited for you to engage in the inspiring research of NC State’s undergraduate students. It is our hope that Dr. George Barthalmus, late Director of the Office of Undergraduate Research who initiated the journal in 2004, would be proud of this endeavor and the continuation of a journal he so passionately supported. Our Editorial Board looks forward to working toward the expansion of undergraduate research and the sharing of research through publication. *INK* is dedicated to continuing to embody NC State’s “Think and Do” tradition within the future of undergraduate research.

Gratefully,

*Ashle M. Page*

*David Nacouzi*

Editors-in-Chief
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IDENTIFICATION OF KEY DRIVERS FOR MUNICIPAL UTILITY PERFORMANCE

by Jasmin Alsaied, Mohamed Bourham, Ph.D. & Michael Fusco, Ph.D.

Jasmin Alsaied is a senior in nuclear engineering with a minor in mathematics and naval science at NC State University. She would like to thank Andy Fusco for his continued support in her research endeavors. Jasmin will be commissioning into the U.S. Navy as a Surface Warfare Officer with the USS Lassen.

Mohamed Bourham, Ph.D. is the Alumni Distinguished Graduate Professor of Nuclear Engineering, and Director of College of Engineering Master of Engineering Program at NC State University. His interests include plasma-matter interaction, plasma propulsion and thrusters, fusion engineering, materials synthesis and coatings, nuclear and mixed waste disposal, drycasks and high-level waste packaging studies. He works in the areas of experimental and computational high heat flux irradiation of materials, studies on multi-layered coatings and corrosion barriers for high level waste packages, and research on evaluation of materials’ corrosion using electrochemical techniques of cyclic potentiodynamic polarization.

Michael Fusco, Ph.D. presented a thesis on the investigation of the corrosion of protective coatings on steel for high-level waste canisters. He currently works as a postdoctoral research associate at the Department of Chemical and Biomolecular Engineering at NC State University.

> Abstract

This report explores the various performance indicators for municipal electric utilities and the greatest impact financial investments can make for improving these indicators. A literature search provided key detail about performing an analysis that would prove useful to utilities to hone in on performance indicators that allowed for the most prudent of investments. Data mining techniques and statistical analyses were performed on data sets concerning the 51 North Carolina municipal electric utilities to identify several key ratios and performance indicators that have the greatest impact on cost of service, system reliability, and customer satisfaction. Statistical analyses were used to determine which investments optimized these outcomes. No other studies on the statistical significance of municipal electric utility performance indicators were identified in our literature search.

Keywords: municipal utility performance, cost analysis of service, electric reliability.
CONTEMPORARY ARTISTS IN FLORENCE

by Monica Galletto
Mentor: Russell Flinchum, Ph.D.

Monica Galletto currently works as a designer at Red Hat, Inc’s global headquarters in Raleigh, NC. Monica graduated summa cum laude from NC State University in Spring 2016 with a Bachelor in Graphic Design and a minor in Business Administration. During her undergraduate career she was involved in the University Honors Program and held positions as an Honors Fellow, Resident Advisor, Design Editor for Windhover, and Design Ambassador for the College of Design. In her field of study she is interested in designing impactful user experiences for individuals and sharing the narratives of local communities through design.

> Abstract

There is a tendency for people to accept art that they are familiar with and to value the old over the new. Florence, Italy, serves as a prime example of this phenomenon due to the fact that millions of tourists visit each year to view the city’s historic artworks; however, this city also hosts a community of contemporary artists, which is often overshadowed by the famous works of deceased artists. Contemporary Artists in Florence (CAF) seeks to bring awareness to a portion of those contemporary artists by sharing their works and personal journeys of creating new art in a historic environment. These stories are documented through interviews, photography, and film, and are compiled into a print magazine and video series. The project educates artists and art enthusiasts about the influence that the past has over present makers and how people assign artistic value. Ultimately, this study reveals the struggles these artists face, shares their creative contributions, and teaches how we as the public can grow our appreciation for living makers.

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MURINE FIBROBLAST RESPONSE TO
ALIGNED POLYLACTIC ACID NANOFIBERS

by Matthew Hartman
Mentor: Russell Gorga, Ph.D.

Matthew Hartman graduated in May of 2015 with a B.S. in Biomedical Engineering with a minor in Tissue Engineering from NC State University and in August of 2016 with a M.S. in Biomedical Science from Wake Forest University. He is currently working as an ORAU contractor with the EPA in developing toxicological assays for nano-materials. Human health applications of biomaterials, nano-materials and structures are his primary research interest.

Abstract

Polylactic acid (PLA) is a well-established biopolymer. It has been approved by the FDA for use in several implantable bioabsorbable implants and is a popular polymer for exploring tissue engineering techniques. Electrospinning is a processing technique which allows for polymer solutions to be “spun” into nanofibers matrices. It is theorized that topographical and mechanical properties provided by electrospun nanofibers allows for them to act as tissue scaffolds with characteristics that illicit improved attachment of cells (Chung, et al., 2009). This experiment investigated how alignment of such nanofibers made of PLA affect fibroblast growth. Aligned fibers were formed by electrospinning onto a rotating drum and unaligned fibers were spun onto a stationary surface. MTT assays and Scanning Electron Microscopy were used to compare cell growth characteristics, the focus was on the rate of cell proliferation and cellular orientation. It was found that aligned nanofibers did increase the rate of growth and there is evidence to suggest that they effect cell alignment.
PARTIAL CHARACTERIZATION OF A NOVEL LIPOPROTEIN, EGF LATROPHILIN AND SEVEN TRANSMEMBRANE DOMAIN CONTAINING 1 (eltd1) IN STRIPED BASS (Morone saxitilis)

by Shelby R. Gandee
Mentors: Justin D. Schilling, Ph.D. & Benjamin J. Reading, Ph.D.

Shelby R. Gandee worked for NC State University as an Undergraduate Research Technician for all three years of school, and loved every moment. Her goals in life are to continue with research, especially in animal behavior. Since graduation, Shelby now works with Clydesdale horses at Busch Gardens Williamsburg.

Abstract

A novel estrogen responsive protein called epidermal growth factor, latrophilin, seven-transmembrane domain containing 1 protein (eltd1, alternatively called adgrl4) was identified as estrogen responsive in the blood plasma of white perch. Little information is known about eltd1 in fishes, more specifically the striped bass – an important commercial fish. It is suggested to play an important role during reproduction by contributing to vitellogenesis through its association with vitellogenins (vtg), and can potentially serve as a biomarker of exposure to environmental estrogens such as endocrine disrupting compounds (EDCs). Current studies have demonstrated EDCs impact fish populations causing reproductive failures linked to dysregulation of vtg expression. Failure to remedy these reproductive impacts in fish species will result in continued declines of wild fish populations. For this reason, an exploratory study was conducted to verify expression of and characterize the novel estrogen responsive gene eltd1 in striped bass (Morone saxitilis). The following objectives were used to characterize eltd1: 1) identify the different tissue types that express eltd1 gene transcripts in male, female, and juvenile striped bass, 2) demonstrate that eltd1 is expressed in juvenile striped bass, 3) demonstrate how eltd1 gene expression changes in striped bass tissues after estrogen induction, 4) perform a sequence analysis on the eltd1 gene transcript and encoded protein, and 5) explore the genomic synteny of eltd1 in vertebrate genomes. A partial sequence of eltd1 was cloned out of striped bass gDNA in both male and female. However, there was no evidence of expression in the particular tissue samples used, with and without estrogen induction.
MORPHOLOGICAL COMPARISON BETWEEN ISLAND POPULATIONS OF THE HOG ISLAND BOA CONSTRICTOR

by Nikole Sederquist & Christopher S. DePerno, Ph.D.
Mentor: Christopher S. DePerno, Ph.D.
Fisheries, Wildlife, and Conservation Biology Program,
Department of Forestry and Environmental Resources,
North Carolina State University, Raleigh, NC 27695

Nikole Sederquist (formerly Nikole Tetreault) graduated from NC State University in 2014 with a Bachelor's in Fisheries, Wildlife, and Conservation Biology. She currently works at Duke University Medical Center as a Comparative Medicine Specialist.

Dr. Christopher S. DePerno is a Professor in the Fisheries, Wildlife, and Conservation Biology Program at NC State University. His research interests include population ecology, management, and habitat selection of a variety of species, animal damage management, wildlife and zoonotic diseases, and public education.

> Abstract

When organisms move from mainlands to islands, changes in body size and head morphology occur as different environmental conditions and prey types and size are encountered. However, it is unclear whether phenotypic plasticity is the reason for differences observed in snake body size and head morphology. Female snakes tend to be larger than males and may use larger prey and be subject to different selective morphological pressures. The Cayos Cochinos consists of two large islands, Cayo Cochino Mayor and Cayo Cochino Menor, which are located off the coast of Honduras. The Hog Island boa constrictors (Boa constrictor imperator) that reside on the islands are smaller compared to individuals on mainland Honduras. However, it is unclear if morphology differences exist between Hog Island boa constrictor populations on the Cayos Cochinos. The mammalian species complex differs between the islands with paca (Agouti paca), agouti (Dasyprocta punctata), and armadillo (Dasypus novemcintus) present on Cayo Cochino Mayor, but absent on Cayo Cochino Menor which may exert different selective morphological pressures. During July –August 2012, we captured boas and measured snout vent length and tail length and head morphology measurements including length, head, labial, ocular, rostral-ocular, nares-ocular, internares, and interocular. We captured 72 snakes (48 males, 24 females); 46 were captured on Cayo Cochino Menor (30 males, 16 females) and 26 were captured on Cayo Cochino Mayor (18 males, 8 females). Nearly all measurements were larger on Cayo Cochino Mayor than on Cayo Cochino Menor and nearly all measurements were larger in females than males. Nearly all measurements were larger in females than males from Cayo Cochino Mayor and females and males from Cayo Cochino Menor. Although the mechanistic pressures between the islands are unclear, we hypothesize that prey availability and size may have exerted evolutionary pressures on the isolated population driving head morphology and differences in body size.
MORE MONEY, MORE PROBLEMS?
SUBJECTIVE SOCIOECONOMIC STATUS,
COPIXNG, AND DAILY PHYSICAL HEALTH

by Anna Fisher
Mentor: Shevaun D. Neupert, Ph.D.

Anna Fisher graduated with a B.A. in psychology and a biology minor from NC State University. During college, she was a member of Delta Delta Delta and an athlete on the competitive cheerleading team. She is currently working as a recruiter for an Information Technology staffing firm in Raleigh, NC.

Abstract

Coping efforts may play a role in older adults’ daily life by affecting the number of physical health symptoms they experience each day. Anticipatory coping is a form of coping that helps prepare for future stressful events, and we focused on preparing for arguments. We looked at physical health symptoms on a daily basis and examined whether subjective socioeconomic status (SES) rankings interacted with four forms of anticipatory coping. Using daily diary data from 43 older adults across 8 consecutive days, multilevel models yielded different results. Plan rehearsal appears to benefit people who view themselves as having fewer resources than others, but negatively impacts those who view themselves as having more resources. In contrast, stagnant deliberation and fantasy outcome are consistent with our hypothesis that the coping efforts have a positive effect on all participants for both high and low self-ranked SES.
DOES ETHNICITY AFFECT HOW OLDER ADULTS DEAL WITH STRESSORS AT HOME?

by Sara S. Monazah, Jennifer A. Bellingtier, Ph.D., Agnes A. Gall, M.S. & Shevaun D. Neupert, Ph.D.

Mentors: Shevaun D. Neupert, Ph.D., Jennifer A. Bellingtier, Ph.D. & Agnes A. Gall, M.S.

Sara S. Monazah is a recent graduate of NC State University where she earned her B.A. in Psychology. She has studied the aging population with a specific interest in how ethnicity can affect home stressor resolution. This fall Sara will begin her Master’s Degree in the department of Social Work at NC State University.

Jennifer A. Bellingtier, Ph.D. is a recent graduate of NC State University’s doctoral program in lifespan developmental psychology. Her research interests focus on individual’s attitudes, beliefs, and feelings about their own aging, as well as how those beliefs develop and impact well-being. In the fall she will begin work as a post-doctoral research associate at Friedrich Schiller University in Jena, Germany.

Agnes A. Gall, M.S. received her master’s degree in Lifespan Developmental Psychology from NC State University. She is interested in the relationships between perceptions of control and coping as they change within a person over time.

Shevaun D. Neupert, Ph.D. is an Associate Professor of Lifespan Developmental Psychology at NC State University. Her research focuses on the dynamic interplay of individual differences and contextual changes associated with health and well-being on a daily basis. She seeks to examine individual and daily characteristics that address the following question: For whom and under which circumstances are health and well-being optimized?

Abstract

Numerous studies have examined stress in older adults but little research has examined the specific relationship between ethnicity and home stressors. We used a micro-longitudinal, eight-day daily diary study to examine reactivity to home stressor resolution. 42 participants from the Greater Raleigh Area documented via these diaries for 337 days. Each participant’s age ranged from 60 to 96 and participants were categorized into either European-American or African-American. Participants reported their daily home stressor resolution (resolved or unresolved) and daily physical symptoms (e.g., joint pain, fatigue, headache). We found that European-Americans had a significantly higher number of physical symptoms on days with an unresolved home stressor than that of their African-American counterparts. Findings suggest that there are ethnic differences in the physical effects of home stressor resolutions among older adults. Awareness of disparity is an important first step in closing this health gap and ethnicity should be included in future assessments of home stressors in older adults.
> Abstract

Many scholars have discussed about varying abortion attitudes in different countries, but little is known about factors influencing this irregularity from one country to another. Bahr and Marcos (2003), Wilson et al. (2011) and Scheepers et al. (2002) consider religious affiliation and education as factors affecting moral liberalization, which influences abortion attitudes. A notable deviation with most studies is that the effect of education doesn't hold true across different nationalities. However, none of them investigate the reason behind such crossborder differences. In response, my research aims to fill this “gap” by studying the relation between power distance practiced in a country and abortion attitudes amongst students of similar educational levels. Data was collected from college students from India and China (countries practicing high power distance), and from the USA and the UK (countries practicing low power distance) using an online survey. Amongst other results, it was found that 17% students from the US and the UK knew 5 to 10 people who had considered abortion compared to 0% from India and China. All students (100%) from the US and the UK chose pregnancy before marriage as a reason for abortion amongst known people, compared to 17% from India and China. This can be an indicator of relatively more liberal abortion attitudes in countries practicing low power distance. These results may indicate that transition of a country from high power to low power distance, a consequence of westernization, can possibly lead to more liberal abortion attitudes.
THE EFFECTS OF ONCOGENES, EXPRESSION OF MICRONAS, AND THEIR RESPECTIVE INHIBITIONS ON THE GROWTH, PROLIFERATION, AND METASTATIC PROPERTIES OF HEPATOCELLULAR CARCINOMA

by Ashwin Ghadiyaram

Ashwin Ghadiyaram is a sophomore undergraduate student majoring in Biological Sciences at NC State University. He is a native of Tennessee and moved around quite a bit, having also lived in Oklahoma City, Oklahoma, for 6 years prior to moving to North Carolina when he was in the 4th grade. Outside of school, his hobbies are aviation spotting, watching basketball, playing basketball, eating good food with friends, and volunteering with the North Carolina Science Olympiad as well as WakeMed.

> Abstract

Hepatocellular carcinoma (HCC) is a cancer of the liver that is quite common and possesses a poor prognosis. Current treatments are ineffective at treating this specific form of cancer, but research over the last decade provides hope to finding more effective treatments in the future. The understanding of two primary variables related to the progression of hepatocellular carcinoma could lead to the discovery of a possible advanced treatment: oncogenic activation/inhibition and increased/decreased microRNA (miRNA) expression. This literature review thoroughly explores both of these phenomena, their benefits, disadvantages, varieties, and effectiveness. The methods utilized by the groups involved the transfection of HCC cell lines expressing specific oncogenes and miRNAs into mice livers in order to observe the effect of the variables on the progression of HCC. Polymerase chain reactions (PCR) were used to transfect cells with desired genetic strands. Flow cytometry analysis (a technology that is used to analyze the physical and chemical characteristics of particles in a fluid as it passes through at least one laser) was used to identify the specific cell cycles cells are in. Decreased progression of HCC was found to be primarily associated with the inhibition of oncogenes and the increased expression of miRNAs. In contrast, the activation of oncogenes and the decreased expression of miRNAs had the opposite effect on HCC. These findings suggest that oncogenes and miRNAs have important roles in the outcome of HCC cell growth.
EFFECTS OF CANCER, CHEMOTHERAPY, AND DOMESTIC VIOLENCE ON FETAL DEVELOPMENT

by Amaya K. Watters
Mentor: Lisa Paciulli, Ph.D.

Amaya K. Watters is a junior in biological sciences at NC State University who intends to go to medical school after graduation. Amaya’s research interests include fetal development, neonatal and maternal health, and oncology.

Abstract

Cancer, chemotherapy treatment, and domestic violence in utero can have negative effects on fetal development. Breast cancer complicates an estimated 1 in 3000 pregnancies (Hahn et al. 2006), ovarian cancer 1 in 8743 (Machado et al. 2006), and domestic violence affects about 6% (Yost et al. 2005). In a large study, 16,041 pregnant women were interviewed using four questions (had a partner hit, insulted, threatened, or screamed at her?) to determine the type of abuse, if any, they experienced during their pregnancies (Yost et al. 2005). The results were compared to investigate any differences among women who reported domestic violence and women who did not. In the case of fetal exposure to cancer or chemotherapy in utero, obstetric, pediatric, and oncologic data was obtained and examined for possible short-term effects (Calsteren et al. 2010). Long-term data for children exposed to maternal cancer and chemotherapy in utero was collected (Avilés and Neri 2001). Although women who reported domestic violence had adverse outcomes, those who declined to be interviewed were at higher risk for more adverse outcomes. On the other hand, children exposed to chemotherapy or cancer in utero generally had good short and long-term prognoses. In all studies, the most frequently observed effect was preterm birth and low birth weight. Adverse outcomes were due to preterm birth rather than the fetal environment itself. Cancer, chemotherapy treatment, and domestic violence have the same impact on fetal development: higher rates of preterm birth and neonatal intensive care unit (NICU) admission.
A GENERAL REVIEW OF RESEARCH ON VARIATION IN HUMAN HEIGHT

by Taylor K. Nguyen
Mentor: Lisa Paciulli, Ph.D.

Taylor K. Nguyen is a junior studying anthropology and evolutionary biology at NC State University, and is an aspiring biological anthropologist. She first began her interests the natural sciences as a child who often visited the Field Museum of Chicago. In the future, Taylor hopes to one day work as a curator for a museum or zoological institute as well as continue to advocate for conservation of species, specimens, and artifacts.

> Abstract

Human stature is a trait that is varied throughout many populations around the world. The variation in human height is found through many different determinants that fall into two umbrella categories, genetic and environmental. In order to study which factors affect adult height, studies on both categories were compared and analyzed. This review paper is primarily about the environmental and genetic factors of height variance in people of European descent. Since individuals of European descent tend to be genetically similar, it is ideal to use them in these studies. The research articles consist of longitudinal, cohort, and crosssectional studies. It was found that overall, genetic factors were more predictive in determining mature adult height than environmental factors. Finding variables related to height are important to know because if we are able to pinpoint the exact determinates of this trait, we may be able to influence height of future generations. In addition, we may be able to alter the effects height has on certain diseases.
A REVIEW OF THE CAUSES AND TREATMENTS OF DEMENTIA

by Millie Hair
Mentor: Lisa Paciulli, Ph.D.

Millie Hair is a biology major at NC State University interested in conservation and will be participating in an internship program at the Duke Lemur Center during Summer 2017. Millie wrote this review at the start of sophomore year after having just spent the summer as her grandmother’s caretaker after her husband passed away. She has dementia, and was the inspiration behind this literature review.

Abstract

Dementia is a broad category of diseases dealing with loss of cognition and memory. Dementia comes in many forms, and is an ever-growing problem. There is no cure for dementia, as it is an irreversible condition. Studies researched treatment options using Salvia officinalis to control choline levels in the brain by comparing the levels before and after patients used the medicinal plant. Another study explored treatments using therapy animals by observing changes in patients’ attitudes when exposed to various dog stimuli. Little is known about the causes of some forms of dementia, but information was gathered in studies to see what causes early-onset dementia, and how complicated dementia can affect patients’ lives. Another possible cause leading to possible treatments was explored in a study that tracked changes in cerebral glucose metabolism over the course of one year. This review sought to learn how dementia is caused and what can be done to treat it. Some possible treatments were found, but further research is needed.
A LITERATURE REVIEW: EFFECTS OF ALTITUDE ON SEA-LEVEL PERFORMANCE AND THE HEART

by Megha Ganatra
Mentor: Lisa Paciulli, Ph.D.

Megha Ganatra graduated from NC State University in Spring 2017 with a degree in Human Biology and a double minor in Anthropology and Psychology. She is currently conducting a research study at the Duke Lemur Center with ruffed lemurs on neonatal outcomes. Her research interests include exercise physiology and effects of cortisol.

Abstract

Many athletes tend to invest a lot of resources into training at high altitudes. It is known that high altitudes induce erythropoiesis, the process of making red blood cells, which results in a higher oxygen carrying capacity. This has been shown to improve sea-level performance. Levine and Stray-Gundersen (1997) examined the effect of moderate-altitude acclimatization with low-altitude training on performance by exposing athletes to different altitudes. They found that living high and training low improves running performance at sea-level. Stray-Gundersen et. al (2001) further studied the effects of high altitude acclimatization and low altitude (HiLo) training using a modified training schedule. The HiLo model for training resulted in an improvement of sea-level performance in athletes. However, there was a large amount of inter-individual variation in erythropoiesis in response to altitude. To study this, Friedmann et. al (2005) examined whether increased hemoglobin mass could be predicted by erythropoietin responses to altitude in junior swimmers. Erythropoietin levels and hemoglobin mass were measured before and after altitude exposure. In addition, altitude induces physical and physiological changes in the heart. Carzorla et. al (2006) looked at how high-altitude exercise training affects contractile function by studying rats placed in different environments. They found that sea-level training improved the transmural gradient of stretch-dependent Ca2+ sensitization. Reboul et. al (2004) studied cardiac remodeling consecutive to altitude in rats with different training conditions, and found that altitude training resulted in left ventricular remodeling. In summary, high altitudes have a variety of effects including improvement in sea-level performance as well as physiological and physical changes in the heart.